

## SEQUENCE LISTING

<110> Hughes, Martin J G  
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<120> Outer Surface Proteins, Their Genes, and Their Use

<130> GJE-71

<140> US 09/868,195

<141> 2001-06-15

<160> 12

<170> PatentIn version 3.1

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 260 265 270

gca aac gca ttt gct ggt tat act gaa gtt cgc gac act gaa ggt gaa 864  
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Gly Ala Lys Leu Glu Glu Ala Ile Asn Ala Leu Glu Asp Gly Gln Val	100	105	110
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Ser Lys Asn Asp Glu Glu Leu Gly Lys Tyr Trp Ala Ser Leu Gly Asp	130	135	140
Gly Ile Phe Val Asn Asp Ala Phe Gly Thr Ala His Arg Ala His Ala	145	150	155
Ser Asn Val Gly Ile Ser Ala Asn Val Glu Lys Ala Val Ala Gly Phe	165	170	175
Leu Leu Glu Asn Glu Ile Ala Tyr Ile Gln Glu Ala Val Glu Thr Pro	180	185	190
Glu Arg Pro Phe Val Ala Ile Leu Gly Gly Ser Lys Val Ser Asp Lys	195	200	205
Ile Gly Val Ile Glu Asn Leu Leu Glu Lys Ala Asp Lys Val Leu Ile	210	215	220
Gly Gly Gly Met Thr Tyr Thr Phe Tyr Lys Ala Gln Gly Ile Glu Ile	225	230	235
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Gly Asn Ser Leu Val Glu Glu Asp Lys Leu Asp Val Ala Lys Asp Leu  
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Leu Glu Lys Ser Asn Gly Lys Leu Ile Leu Pro Val Asp Ser Lys Glu  
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Gly Gly Gly Asp Ser Ala Ala Ala Ala Ile Asn Leu Gly Arg Ala Asp  
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 35 40 45

atg gaa cct cca gaa aac tat gac aaa gaa gaa ttt tct cgc att caa 192  
 Met Glu Pro Pro Glu Asn Tyr Asp Lys Glu Glu Phe Ser Arg Ile Gln  
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 Gly Ile Gly Gly Ser Tyr Leu Gly Ala Lys Ala Ala Ile Asp Phe Leu  
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 115 120 125

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 130 135 140

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 Lys Ser Gly Thr Thr Thr Glu Pro Ala Ile Ala Phe Arg Val Phe Lys  
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Met Glu Pro Pro Glu Asn Tyr Asp Lys Glu Glu Phe Ser Arg Ile Gln  
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Lys Ala Ala Glu Lys Ile Lys Ser Asp Ser Glu Val Leu Val Val Ile  
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Gly Ile Gly Gly Ser Tyr Leu Gly Ala Lys Ala Ala Ile Asp Phe Leu  
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Asn Asn His Phe Ala Asn Leu Gln Thr Ala Glu Glu Arg Lys Ala Pro  
 100 105 110

Gln Ile Leu Tyr Ala Gly Asn Ser Ile Ser Ser Thr Tyr Leu Ala Asp  
 115 120 125

Leu Val Glu Tyr Val Gln Asp Lys Glu Phe Ser Val Asn Val Ile Ser  
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Asp Gly Gly Val Pro Asn Met Phe Val Thr Leu Pro Thr Gln Asp Ala  
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 65 70 75 80  
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 Ala Tyr Lys Arg Asn Met Phe Ala Phe Gly Lys Pro Gly Phe Glu Glu  
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 Tyr Thr Leu Gly Tyr Thr Ile Tyr Phe Phe Glu Leu Ala Ile Gly Leu  
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 Ser Gly Tyr Leu Asn Ser Val Asn Pro Phe Asp Gln Pro Gly Val Glu  
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Ala	Ala	Gly	Gly	Ile	Gly	Tyr	Gly	Pro	Gly	Thr	Leu	Met	Leu	Ile	Lys	
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gac	cac	atc	aat	atg	att	ggg	act	aac	cct	ctc	ata	ggg	gag	aac	ctt	432
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Glu	Glu	Phe	Gly	Pro	Arg	Phe	Pro	Asp	Met	Ser	Asp	Ala	Tyr	Thr	Ala	
145					150				155						160	
aca	tat	cga	caa	aaa	gct	cac	caa	att	gct	gaa	aac	gat	atc	aaa	ctc	528
Thr	Tyr	Arg	Gln	Lys	Ala	His	Gln	Ile	Ala	Glu	Asn	Asp	Ile	Lys	Leu	
				165				170						175		
gaa	gaa	ggg	gtg	tac	ttg	ggg	gta	tca	gga	ccc	act	tat	gaa	aca	cct	576
Glu	Glu	Gly	Val	Tyr	Leu	Gly	Val	Ser	Gly	Pro	Thr	Tyr	Glu	Thr	Pro	
			180				185						190			

gca gaa att cgt gca ttc caa aca atg ggc gca caa gcg gta ggt atg 624  
 Ala Glu Ile Arg Ala Phe Gln Thr Met Gly Ala Gln Ala Val Gly Met  
 195 200 205

tcc acg gtt cca gag gtg atc gtt gca gct cac tca ggg ctt aaa gtg 672  
 Ser Thr Val Pro Glu Val Ile Val Ala Ala His Ser Gly Leu Lys Val  
 210 215 220

tta gga att tca gca att act aac ctt gcc gct ggc ttc caa tca gag 720  
 Leu Gly Ile Ser Ala Ile Thr Asn Leu Ala Ala Gly Phe Gln Ser Glu  
 225 230 235 240

ctc aat cat gag gag gtc gtt gaa gtt act cag cgt att aaa gaa gat 768  
 Leu Asn His Glu Glu Val Val Glu Val Thr Gln Arg Ile Lys Glu Asp  
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Lys Gly Val Thr Ala Pro Glu Phe Gly Leu Ile Leu Gly Ser Gly Leu  
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Gly Glu Leu Ala Glu Glu Ile Glu Asn Pro Ile Val Val Asp Tyr Ala  
 35 40 45

Asp Ile Pro Asn Trp Gly Gln Ser Thr Val Val Gly His Ala Gly Lys  
 50 55 60

Phe Ser Val Trp Asp Leu Ser Gly Arg Lys Val Leu Ala Leu Gln Gly  
 65 70 75 80

Arg Phe His Phe Tyr Glu Gly Asn Thr Met Glu Val Val Thr Phe Pro  
 85 90 95

Val Arg Ile Met Arg Ala Leu Ala Cys His Ser Val Leu Val Thr Asn  
 100 105 110

Ala Ala Gly Gly Ile Gly Tyr Gly Pro Gly Thr Leu Met Leu Ile Lys  
 115 120 125

Asp His Ile Asn Met Ile Gly Thr Asn Pro Leu Ile Gly Glu Asn Leu  
 130 135 140

Glu Glu Phe Gly Pro Arg Phe Pro Asp Met Ser Asp Ala Tyr Thr Ala  
 145 150 155 160

Thr Tyr Arg Gln Lys Ala His Gln Ile Ala Glu Asn Asp Ile Lys Leu  
 165 170 175

Glu Glu Gly Val Tyr Leu Gly Val Ser Gly Pro Thr Tyr Glu Thr Pro  
 180 185 190

Ala Glu Ile Arg Ala Phe Gln Thr Met Gly Ala Gln Ala Val Gly Met  
 195 200 205

Ser Thr Val Pro Glu Val Ile Val Ala Ala His Ser Gly Leu Lys Val  
 210 215 220

Leu Gly Ile Ser Ala Ile Thr Asn Leu Ala Ala Gly Phe Gln Ser Glu  
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Leu Asn His Glu Glu Val Val Glu Val Thr Gln Arg Ile Lys Glu Asp  
 245 250 255

Phe Lys Gly Leu Gly Lys Ser Leu Val Ala Glu Leu  
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 gtt aat cag att gag att ttg tca cca att gat gat tct tca ttg gga 96

Val	Asn	Gln	Ile	Glu	Ile	Leu	Ser	Pro	Ile	Asp	Asp	Ser	Ser	Leu	Gly		
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Phe	Val	Pro	Ala	Met	Thr	Arg	Glu	Glu	Val	Asp	His	Ala	Met	Lys	Ala		
		35					40				45						
ggt	cgt	gag	gct	tta	cca	gct	tgg	gct	gct	tta	aca	gta	tat	gaa	cgt	192	
Gly	Arg	Glu	Ala	Leu	Pro	Ala	Trp	Ala	Ala	Leu	Thr	Val	Tyr	Glu	Arg		
	50					55				60							
gca	caa	tac	ctt	cat	aaa	gcc	gca	gac	att	att	gaa	cgt	gat	aaa	gaa	240	
Ala	Gln	Tyr	Leu	His	Lys	Ala	Ala	Asp	Ile	Ile	Glu	Arg	Asp	Lys	Glu		
65					70				75						80		
gaa	att	gct	act	gtt	tta	gca	aaa	gaa	att	tct	aaa	gct	tac	aat	gct	288	
Glu	Ile	Ala	Thr	Val	Leu	Ala	Lys	Glu	Ile	Ser	Lys	Ala	Tyr	Asn	Ala		
			85					90						95			
tca	gta	act	gag	gtt	gta	agg	aca	gct	gat	ctt	att	cgt	tat	gca	gca	336	
Ser	Val	Thr	Glu	Val	Val	Arg	Thr	Ala	Asp	Leu	Ile	Arg	Tyr	Ala	Ala		
			100					105					110				
gaa	gaa	gga	att	cgt	tta	tca	act	tca	gct	gac	gaa	ggt	gga	aaa	atg	384	
Glu	Glu	Gly	Ile	Arg	Leu	Ser	Thr	Ser	Ala	Asp	Glu	Gly	Gly	Lys	Met		
		115					120					125					
gat	gct	tca	aca	ggt	cat	aag	ttg	gct	gtt	att	cgt	cgt	caa	cca	gta	432	
Asp	Ala	Ser	Thr	Gly	His	Lys	Leu	Ala	Val	Ile	Arg	Arg	Gln	Pro	Val		
	130					135					140						
ggt	atc	gtt	tta	gca	atc	gca	cct	tat	aat	tac	cct	gtt	aac	ctc	tca	480	
Gly	Ile	Val	Leu	Ala	Ile	Ala	Pro	Tyr	Asn	Tyr	Pro	Val	Asn	Leu	Ser		
145					150					155					160		
gga	tca	aaa	att	gcg	cca	gct	cta	att	ggt	gga	aac	gtt	gtg	atg	ttt	528	
Gly	Ser	Lys	Ile	Ala	Pro	Ala	Leu	Ile	Gly	Gly	Asn	Val	Val	Met	Phe		
			165					170						175			
aaa	cca	cca	aca	caa	ggt	tca	gtc	tca	gga	ctt	gtt	tta	gca	aaa	gct	576	
Lys	Pro	Pro	Thr	Gln	Gly	Ser	Val	Ser	Gly	Leu	Val	Leu	Ala	Lys	Ala		
			180					185					190				
ttt	gca	gaa	gca	ggt	ctt	cca	gca	ggt	gtc	ttt	aat	act	att	aca	gga	624	
Phe	Ala	Glu	Ala	Gly	Leu	Pro	Ala	Gly	Val	Phe	Asn	Thr	Ile	Thr	Gly		
		195					200					205					
cgc	ggt	tct	gag	att	gga	gat	tac	att	gtt	gag	cat	gaa	gaa	gtt	aat	672	
Arg	Gly	Ser	Glu	Ile	Gly	Asp	Tyr	Ile	Val	Glu	His	Glu	Glu	Val	Asn		
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Phe	Ile	Asn	Phe	Thr	Gly	Ser	Thr	Pro	Val	Gly	Gln	Arg	Ile	Gly	Lys		
225					230					235					240		
ttg	gca	gga	atg	cgt	cca	att	atg	ctt	gag	ttg	ggc	ggt	aag	gat	gca	768	
Leu	Ala	Gly	Met	Arg	Pro	Ile	Met	Leu	Glu	Leu	Gly	Gly	Lys	Asp	Ala		

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ggt gca ggt gct tat gat tac tct gga caa cgc tgt acg gca att aag Val Ala Gly Ala Tyr Asp Tyr Ser Gly Gln Arg Cys Thr Ala Ile Lys 275 280 285			864
cgt gtg ctt gtc gtt gaa gaa gtt gcw gat gaa ttg gca gaa aaa ata Arg Val Leu Val Val Glu Glu Val Ala Asp Glu Leu Ala Glu Lys Ile 290 295 300			912
tct gaa aat gta gca aaa tta tca gta ggt gat cca ttt gat aat gca Ser Glu Asn Val Ala Lys Leu Ser Val Gly Asp Pro Phe Asp Asn Ala 305 310 315 320			960
acg gtg aca ccg gtt att gat gat aat tca gct gac ttt att gaa agc Thr Val Thr Pro Val Ile Asp Asp Asn Ser Ala Asp Phe Ile Glu Ser 325 330 335			1008
tta gta gta gat gca cgt caa aaa ggt gcg aaa gaa ttg aat gaa ttt Leu Val Val Asp Ala Arg Gln Lys Gly Ala Lys Glu Leu Asn Glu Phe 340 345 350			1056
aaa cgt gat ggt cgt cta tta act cca gga ttg ttt gat cat gtt act Lys Arg Asp Gly Arg Leu Leu Thr Pro Gly Leu Phe Asp His Val Thr 355 360 365			1104
tta gat atg aaa cta gct tgg gaa gag cct ttt gga cca att ctc cca Leu Asp Met Lys Leu Ala Trp Glu Glu Pro Phe Gly Pro Ile Leu Pro 370 375 380			1152
att att cgt gtc aag gat gca gaa gaa gct gtt gct att gcc aac aaa Ile Ile Arg Val Lys Asp Ala Glu Glu Ala Val Ala Ile Ala Asn Lys 385 390 395 400			1200
tct gat ttt gga tta caa tca tca gtc ttt aca cgt gat ttc caa aaa Ser Asp Phe Gly Leu Gln Ser Ser Val Phe Thr Arg Asp Phe Gln Lys 405 410 415			1248
gca ttt gat ata gca aat aaa ctt gaa gtt ggt aca gtt cac att aac Ala Phe Asp Ile Ala Asn Lys Leu Glu Val Gly Thr Val His Ile Asn 420 425 430			1296
aat aag act gga cgt ggt ccw gat aat ttc cca ttc tta gga ctc aaa Asn Lys Thr Gly Arg Gly Pro Asp Asn Phe Pro Phe Leu Gly Leu Lys 435 440 445			1344
gga tct ggt gca ggt gtt caa ggt atc aga tat tca att gaa gca atg Gly Ser Gly Ala Gly Val Gln Gly Ile Arg Tyr Ser Ile Glu Ala Met 450 455 460			1392
aca aat gta aaa tcg att gtt ctc gat atg aaa tag Thr Asn Val Lys Ser Ile Val Leu Asp Met Lys 465 470 475			1428



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Val Asn Gln Ile Glu Ile Leu Ser Pro Ile Asp Asp Ser Ser Leu Gly  
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Phe Val Pro Ala Met Thr Arg Glu Glu Val Asp His Ala Met Lys Ala  
 35 40 45

Gly Arg Glu Ala Leu Pro Ala Trp Ala Ala Leu Thr Val Tyr Glu Arg  
 50 55 60

Ala Gln Tyr Leu His Lys Ala Ala Asp Ile Ile Glu Arg Asp Lys Glu  
 65 70 75 80

Glu Ile Ala Thr Val Leu Ala Lys Glu Ile Ser Lys Ala Tyr Asn Ala  
 85 90 95

Ser Val Thr Glu Val Val Arg Thr Ala Asp Leu Ile Arg Tyr Ala Ala  
 100 105 110

Glu Glu Gly Ile Arg Leu Ser Thr Ser Ala Asp Glu Gly Gly Lys Met  
 115 120 125

Asp Ala Ser Thr Gly His Lys Leu Ala Val Ile Arg Arg Gln Pro Val  
 130 135 140

Gly Ile Val Leu Ala Ile Ala Pro Tyr Asn Tyr Pro Val Asn Leu Ser  
 145 150 155 160

Gly Ser Lys Ile Ala Pro Ala Leu Ile Gly Gly Asn Val Val Met Phe  
 165 170 175

Lys Pro Pro Thr Gln Gly Ser Val Ser Gly Leu Val Leu Ala Lys Ala  
 180 185 190

Phe Ala Glu Ala Gly Leu Pro Ala Gly Val Phe Asn Thr Ile Thr Gly  
 195 200 205

Arg Gly Ser Glu Ile Gly Asp Tyr Ile Val Glu His Glu Glu Val Asn  
 210 215 220

Phe Ile Asn Phe Thr Gly Ser Thr Pro Val Gly Gln Arg Ile Gly Lys  
 225 230 235 240

Leu Ala Gly Met Arg Pro Ile Met Leu Glu Leu Gly Gly Lys Asp Ala  
 245 250 255

Gly Ile Val Leu Ala Asp Ala Asp Leu Asp Asn Ala Ala Lys Gln Ile  
 260 265 270

Val Ala Gly Ala Tyr Asp Tyr Ser Gly Gln Arg Cys Thr Ala Ile Lys  
 275 280 285

Arg Val Leu Val Val Glu Glu Val Ala Asp Glu Leu Ala Glu Lys Ile  
 290 295 300

Ser Glu Asn Val Ala Lys Leu Ser Val Gly Asp Pro Phe Asp Asn Ala  
 305 310 315 320

Thr Val Thr Pro Val Ile Asp Asp Asn Ser Ala Asp Phe Ile Glu Ser  
 325 330 335

Leu Val Val Asp Ala Arg Gln Lys Gly Ala Lys Glu Leu Asn Glu Phe  
 340 345 350

Lys Arg Asp Gly Arg Leu Leu Thr Pro Gly Leu Phe Asp His Val Thr  
 355 360 365

Leu Asp Met Lys Leu Ala Trp Glu Glu Pro Phe Gly Pro Ile Leu Pro  
 370 375 380

Ile Ile Arg Val Lys Asp Ala Glu Glu Ala Val Ala Ile Ala Asn Lys  
 385 390 395 400

Ser Asp Phe Gly Leu Gln Ser Ser Val Phe Thr Arg Asp Phe Gln Lys  
 405 410 415

Ala Phe Asp Ile Ala Asn Lys Leu Glu Val Gly Thr Val His Ile Asn

420

425

430

Asn Lys Thr Gly Arg Gly Pro Asp Asn Phe Pro Phe Leu Gly Leu Lys  
435 440 445

Gly Ser Gly Ala Gly Val Gln Gly Ile Arg Tyr Ser Ile Glu Ala Met  
450 455 460

Thr Asn Val Lys Ser Ile Val Leu Asp Met Lys  
465 470 475

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